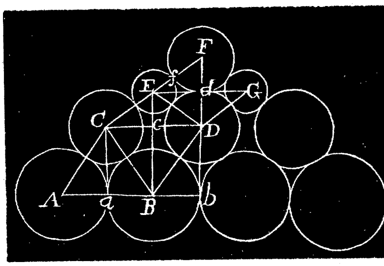
Solution by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia; I L. BEVERAGE, Monterey, Virginia; and the Proposer.

Let A, B, C, D, E, F, G, be centres of the logs as seen in the figure.



Now $CD=AB=ab=EG$.

$\therefore\ Ed=\frac{1}{2}EG=2$.

$EF^2-4=dF^2$, $ED^2-4=dD^2$,

$\sqrt{EF^2-4}+\sqrt{6\frac{1}{4}-4}=DF$.

$EF=Ef+fF$, $DF=1\frac{1}{2}+fF$,

$\sqrt{fF^2+2fF-3}+\sqrt{2\frac{1}{4}}=1\frac{1}{2}+fF$,

$\sqrt{fF^2+2fF-3}=fF$,

$fF^2+2fF-3=fF^2$,

$fF=1\frac{1}{2}$.

$\therefore$ the diameter required=3 feet.

This problem was also solved by *A. L. FOOTE, JOHN T. FAIRCHILD, J. A. CALDERHEAD, H. C. WHITAKER, H. W. HOLYCROSS, P. S. BERG, CHARLES E. MYERS,* and *C. D. STILLSON.*

10. Proposed by MISS LECTA MILLER, B. L., Professor of Natural Science and Art, Kidder Institute, Kidder, Missouri.

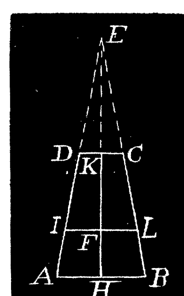
A carpenter is obliged to cut a board, that is in the form of a trapezoid, crosswise into two equivalent parts. The board is 12ft. long, 2 ft, wide at one end, and one foot wide at the other. How far from the narrow end must he cut?

Solution by B. F. FINKEL, Professor of Mathematics, Kidder Institute, Kidder, Missouri.

1. Let $ABCD$ be the board.
2. $AB=2$ feet$=b$, the width of the large end,
3. $DC=1$ foot$=c$, the width of the small end, and
4. $HK=12$ feet$=a$, the length of the board.
5. Produce HK, AD, and BC till they meet in E. Then by similar triangles,
6. $ABE : EIL : EDC :: AB^2 : LI^2 : DC^2$. But
7. $EIL=EDC+\frac{1}{2}(ABCD)=\frac{1}{2}(2\ EDC+ABCD)=\frac{1}{2}(EDC+EDC+ABCD)=\frac{1}{2}(EDC+EAB)$.
8. $\therefore\ IL^2=\frac{1}{2}(AB^2+DC^2)=\frac{1}{2}(b^2+c^2)$.

II. 9. $\therefore\ IL=\sqrt{\frac{1}{2}(b^2+c^2)}=\sqrt{\frac{1}{2}(2^2+1^2)}=\frac{1}{2}\sqrt{10}$ ft., the dividing line.

10. Area of $ABCD=\frac{1}{2}(AB+CD)\times KH=\frac{1}{2}(b+c)a=18$ sq. ft.
11. $\therefore$ Area of $ABIL=\frac{1}{2}ABCD=\frac{1}{4}(b+c)a=9$ sq. ft.
12. But area of $DCIL=\frac{1}{2}(DC+IL)\times KF$
$=\frac{1}{2}[c+\sqrt{\frac{1}{2}(b^2+c^2)}]\times KF=\frac{1}{2}(2+\sqrt{10})\times KF$.
13. $\therefore\ \frac{1}{2}(c+\sqrt{\frac{1}{2}(b^2+c^2)})\times KF=\frac{1}{4}(b+c)a$, whence
14. $KF=\dfrac{\frac{1}{2}(b+c)a}{[c+\sqrt{\frac{1}{2}(b^2+c^2)}]}=\dfrac{18}{\frac{1}{2}(2+\sqrt{10})}=\dfrac{36}{2+\sqrt{10}}=$ 6.973666+feet.



III. $\therefore$ He must saw it in two at 6.973666+feet from the narrow end.

This problem was also solved by *G. B. M. Zerr, P. S. Berg, Charles E. Myers, J. A. Calderhead, A. L. Foote, H. C. Whitaker, H. W. Holycross, H. M. Cash* and *F. A. Swanger.*

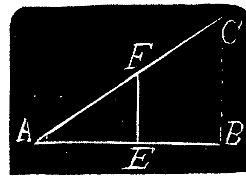
11. Proposed by L. B. HAYWARD, Superintendent of Schools, Bingham, Ohio.

What length of rope will be required to draw water from a well, it being 38

feet to the water, the sweep to be supported by an upright post 20 feet high, and standing 20 feet from the well, and the foot of the sweep to strike the ground 20 feet from the foot of the upright post?

11. Solution by JOHN T. FAIRCHILD, Ada, Ohio.

AE=20 feet; FE, the post, =20 feet; BE =20 ft; and CB will be the required length of the rope.



By the similar triangles ABC and AEF, we have $AE:EF::AB:CB$, or 20 ft. : 20 ft. :: 40 feet : (CB =40 feet).

Also solved by *G. B. M. Zerr*, *A. L. Foote*. *H. C. Whitaker*, and *I. L. Beverage*.

12. Proposed by CHARLES E. MYERS, Canton, Ohio.

A man made his will to this effect: that if only the daughter returned home his wife should have $\frac{2}{3}$ and the daughter $\frac{1}{3}$ of the estate; and if only the son returned his wife should have $\frac{1}{3}$ and the son $\frac{2}{3}$. But the son and daughter both returned. How should the estate be divided?

I. Solution by M. A. GRUBER, A.M., War Department, Washington, D. C.

By the first condition, the wife's share =2 times the daughter's share.

By the second condition, the son's share =2 times the wife's share, hence 4 times the daughter's share.

The D's share = D's share;
The W's share =2 D's share;
The S's share =4 D's share.

D's+W's+S's shares=7 D's share = the estate.

$\therefore$ D's share $=\frac{1}{7}$ of estate,
W's share $=\frac{2}{7}$ of estate,
S's share $=\frac{4}{7}$ of estate.

II. Solution by A. L. FOOTE, C. E., No. 80 Broad St., New York City.

Relatively the expectation of the son is double that of the mother, and the mother double that of the daughter, hence if we give the son four parts, the mother two parts and the daughter one part, we divide the estate into 7 equal parts and the daughter has $\frac{1}{7}$ of it, the wife $\frac{2}{7}$, and the son $\frac{4}{7}$.

There is, however, a legal aspect to this question. In the event of the son and daughter both returning the wife might legally claim her $\frac{1}{3}$ in which case the $\frac{2}{3}$ of the estate would be shared by the son and daughter in the ratio of 2 to 1 or the son would receive $\frac{4}{9}$ and the daughter $\frac{2}{9}$ of the estate.

Also solved by *G. B. M. Zerr*, *Robert J. Aley*, *H. C. Whitaker*, *W. F. Bradbury*, and *P. S. Berg*.

[NOTE.—This class of problems probably originated with the Romans whose laws of inheritance gave rise to numerous arithmetical problems. Professor Cajori, in his *History of Mathematics*, p. 80, quotes a problem involving the same principle and numbers as the one above. He further states that the celebrated Roman jurist, Salvianus Julianus, decided that the estate should be divided in the manner indicated by the above solutions.

According to modern jurisprudence, a will of this kind would very probably be set aside and an equal distribution of the estate be made.—ED.]